

VOLVO



HÖGSKOLAN
I HALMSTAD

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HEALTH

Hazard Estimation and Analysis
of Lifelong Truck Histories



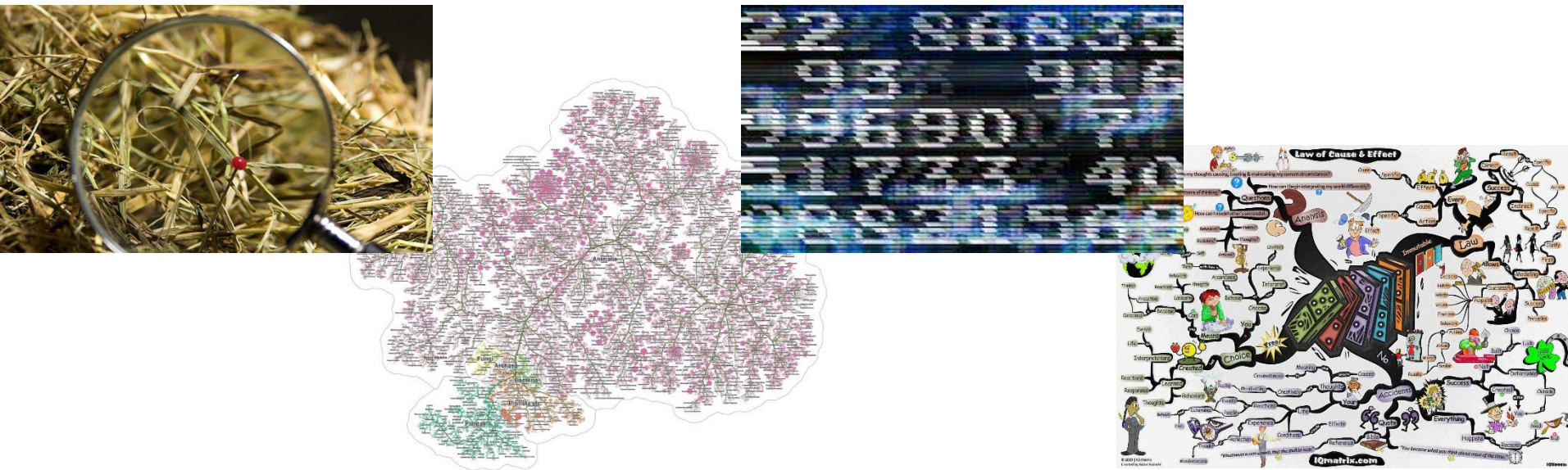
Business Landscape

- We have already launched Volvo Uptime Promise
 - but we need more features in the offer – TODAY!
 - this means that we have both the infrastructure and the capabilities to launch new findings fast
- Our ongoing machine learning activities need a boost
 - infrastructure and tools are now in place (Netezza, SPSS modeler, CADS, R)
 - our current team is:
 - 2 Postdocs & PhD student from Halmstad
 - 3 Data Scientists from Volvo
 - 2 consultants from IBM



Modelling history

- Trucks are very complex, highly inter-connected systems
- Every event in their history has long-lasting consequences
- It's difficult to understand important patterns in those histories



Research Questions



- Identify important events & periods
 - how to select what to include in the model & what to discard?
- Capture similarities and individual traits of vehicles
 - how to reveal hidden general patterns, as well as exceptions?
- Design ML methods that explain their decisions
 - how to build model based on concepts familiar to mechanics?
 - how to incorporate (active & passive) workshop feedback?

Program Relevance



FFI programme goals

- A more **sustainable society** through prolonged vehicle life
- Quality is crucial for **competitiveness** of Swedish automotive cluster
- New solutions rise importance of highly **skilled personnel** in Sweden
- Timely and cheaper transport solutions through **higher dependability**

Machine Learning programme goals

- In real **business setting** verify and validate solutions based on ML
- Capture, describe, and predict behaviour of **complex vehicle systems**
- Offer **personalized** maintenance functionality based on **actual usage**
- Improve **robust** modelling, optimization & **decision making** processes

Proposed Method

Sequence model capturing three aspects of truck history



- Determine the relevant states
- Build a sequential probabilistic model
- Understand the relationships between states
- Discover common causes for component failures

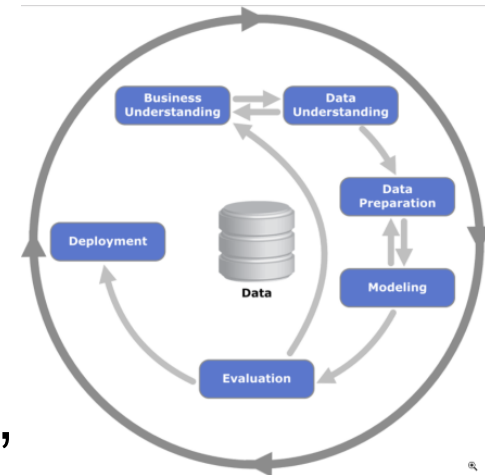
Results

- A **method** for representing complete truck history
- Adaptation of Machine Learning **algorithms** to complex data
- 20% **accuracy increase** in predicting faults across several components
- Three papers in scientific **journals** & presentations in ML conferences
- **Competence transfer** to data scientists at Volvo
- Insight into optimization of maintenance scheduling
- Insight into determination of causes and consequences of failures
- Prototype implementation of the method within Volvo infrastructure
- Continuous deployment of solutions into Volvo service offering



Results Deployment

- We will utilize CRISP project model
 - it has been proven for this kind of work
- We will have actual working implementation, with real data, after two years ready for evaluation
 - When predictions are “good enough” the system will do predictions every night and publish their results in VOSP
 - Those will be directly available to workshop mechanics
 - Initial launch of the first version is planned early 2018
 - The “complete history” predictions can be deployed and evaluated continuously, as they become ready



Partners and their contribution



- Volvo contributes with:
 - the analytics platform
 - knowledge of quality analysis
 - data collected on-board
 - data in off-board databases
 - knowledge about truck design
 - business know-how
 - domain understanding



- Halmstad University contributes with:
 - data mining expertise
 - streaming big data competence
 - join human-machine learning
 - state-of-the-art learning algorithms
 - knowledge of data processing
 - creation and evaluation of models
 - access to research networks



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